

FIELD

The invention concerns Biomass materials being converted to cellulose, lignin, hemi-cellulose, carbohydrates and carbon dioxide by an economical method wherein heat, water and alkali catalyst recoverable and reused. This method consist of mixing the biomass with a recovered aqueous alkali metal hydroxide, then heat the mixture while agitating to evaporated off excess water. The heat is continued until reaction is exothermic, and heat is controlled by means of a heat exchange system. The aqueous alkali metal solution breaks the lignin-cellulose bond. On further heating carbon dioxide is removed from the lignin and cellulose materials thereby producing water soluble materials, consisting of modified sodium lignin, hemi-cellulose, carbohydrates and tall oils, fatty oils and resin oils . Over 90 percent of the biomass is converted to water soluble products and the carbohydrates may be crystalized out from a concentrated aqueous solution of the converted biomass. The carbohydrates are fermented to alcohol.

#### BACKGROUND OF THE INVENTION

This invention relates to an improved and an economical process to convert biomass containing lignin-cellulose into water soluble hemicellulose, carbohydrates, lignin, lignin-cellulose resinous products, tall oil, turpentine and CO<sub>2</sub>. In U. S. Patent No. 4,321,360 issued 03/22/82 to David H. Blount, M.D., it illustrated the process to break-down cellulose-containing plants into water-soluble polymers, but did not include the production of ethanol, lignin resinous products and the recover of the alkali metal catalyst. Other inventors have utilized acids to break down the cellulose to carbohydrates or may use an alkali metal hydroxide to separate the lignin from cellulose then using an acid such as sulfuric acid to break down the cellulose to carbohydrates.. In the improved process of this invention, the biomass is first mixed and wet with the recovered aqueous alkali metal hydroxide in order to distribute the alkali metal catalyst though out the biomass and break the lignin-cellulose bond. The alkali metal hydroxide is used in a sufficient amount to produce a thermal reaction. This reaction removes carbon dioxide from the cellulose to produce carbohydrates and from the lignin to produce a modified lignin. This process also differs from U.S Patent No. 4,321,360, because in the process of evaporating off the excess water the

Jc983 U.S. PTO  
01/05/01

Jc929 U.S. PTO  
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